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NASA TECH BRIEF

Marshall Space Flight Center

Prediction of Flow-Induced Failures of Braided Flexible Hoses and Bellows

The problem:

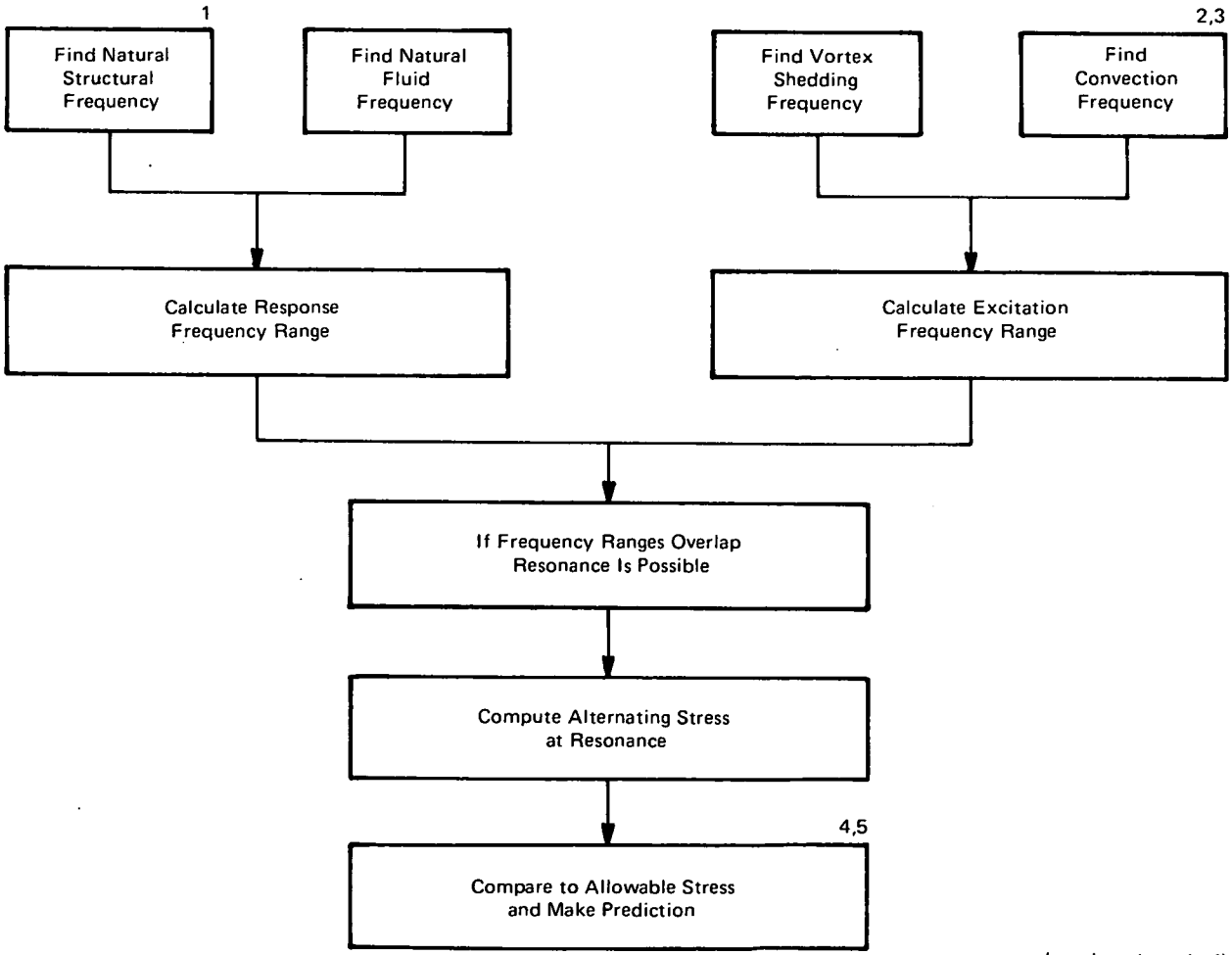
Systems of braided flex hoses and bellows have been known to fail from flow-induced vibrations. It would be very helpful to predict the conditions likely to lead to such failures without the need for extensive testing.

The solution:

Analytical techniques were developed to evaluate braided hoses and bellows for the possibility of flow-induced resonance. These techniques determine the likelihood of high-cycle fatigue failure when such resonance exists.

How it's done:

A single convolution is analyzed considering coupling between the convolutions and the fluid within. The following is a flow chart of the analysis.



(continued overleaf)

1. For free bellows, longitudinal modes are considered in addition to single convolutions.
2. Convection frequency is associated with the fluid velocity past convolutions.
3. Fluid structural response frequencies can also be excited at twice the convection excitation frequency.
4. The predictions are good for braided hoses and, at high pressure, for relatively stiff free bellows.
5. A prediction of "adequate" is reliable, but a predicted failure must be flow tested for proof.

Notes:

1. This analysis proved its usefulness in helping to find the cause of the failure of flex lines in the Apollo/ Saturn 502.

2. Requests for further information may be directed to:
   Technology Utilization Officer
   Marshall Space Flight Center
   Code A&TS-TU
   Huntsville, Alabama 35812
   Reference: B72-10407

Patent status:

No patent action is contemplated by NASA.

Source: L. E. Sack, R. L. Nelson, D. R. Mason, and R. A. Cooper of North American Rockwell Corp. under contract to Marshall Space Flight Center (MFS-19004)